BIOLOGICAL ASSESSMENT
OF THE
PAWLEYS ISLAND
GENERAL INVESTIGATION STUDY
OF
HURRICANE AND STORM DAMAGE REDUCTION
GEORGETOWN COUNTY, SOUTH CAROLINA

MARCH 2003

1.00 INTRODUCTION

Pawleys Island is located on the Atlantic coast in Georgetown County, approximately 70 miles north of Charleston, South Carolina (SC) and 23 miles south of Myrtle Beach, SC. The 3.5-mile long island reaches from Pawleys Inlet at the south end to the north terminal groin at Midway Inlet. The Pawleys Island hurricane and storm damage reduction GI study is being conducted in response to a resolution adopted on 22 April 1988 by the Committee on Environment and Public Works of the United States Senate. An environmental assessment (EA) is being prepared to evaluate improved damage protection for the island. This document will be incorporated in the EA.

The purpose of this project is to protect the island structures from the impacts of storm events, with a secondary benefit of providing additional beach and dune area that will facilitate more sea turtle nesting, as well as provide more substrate for endangered sea beach amaranth planting to foster it's re-colonization and valuable habitat for the Wilson's plover and least tern. Development at the south end has been severely impacted in the past. When hurricane Hugo hit the area, 27 of the 29 houses located there were destroyed. Further, a channel breached the southern spit but has been subsequently filled and the houses rebuilt. The north end of the island seems to be adequately protected by a terminal groin, but there are still significant erosion problems along the south reach. Several limited re-nourishment jobs along the southern reach have been completed by the Town in the last 15 years in an effort to reduce ongoing erosion damage, but a more substantial effort is needed. See the attached Figure 1 for the project location.

2.00 PROPOSED PROJECT

The study area extends from the south end of the south parking lot to approximately 450 feet north of the 2nd Avenue public access (see Figure 1). The study area is divided into three separate reaches. The Southern Reach extends from the south end of the south parking lot to Groin #12, which is located approximately 1,860 feet north of the Hazard Street public access. The Central Reach extends from Groin #12 to Groin #22 and provides no public access or parking opportunities. The Northern Reach extends from Groin #22 to approximately 450 feet north of the 2nd Avenue public access. The results of the study show that a Federal storm damage protection project could only be justified for the Southern Reach (see Figure 1). Therefore, sand placement will be limited to the Southern Reach of the island.

In order to address any concerns that may exist regarding the procedure, construction would be by means of a hydraulic pipeline cutterhead dredge or a hopper dredge. The pipeline would run adjacent to the groins and parallel with the beach. Beach compatible material (sand) from offshore sources would be pumped along the 7,500 linear feet reach of the project and would be discharged as a slurry to a design elevation of 10 feet NGVD. A total 565,000 CY will be placed along 6,800 linear feet of full nourishment between Groin #1 and Groin # 12 with 350-foot tapers on each end of the full nourishment template. The recommended plan also includes a protective berm fronted by an advance nourishment template (see Figure 2: a typical cross-section). The taper below Groin #1 will likely be supported by a groin tied into the south end of the existing parking lot. The taper above Groin #12 will tie into the existing shoreline. The sand will cover an average width of approximately 145 feet of existing intertidal zone (approximately 25 acres) and an average width of approximately 250 feet of existing sub tidal zone (approximately 40 acres). During construction, temporary training dikes of sand would be used to contain the discharge and control the fill placement. Fill sections will be graded by land based equipment, such as bulldozers and articulated front-end loaders, and other equipment as necessary. Equipment will be selected based on whatever proves to be the most advantageous economically, as well as what generates only minimal and acceptable temporary environmental impacts. The sand will then be graded, raked, and tilled as necessary in coordination with recommendations and requirements from regulatory agencies. All work is expected to be performed between October 15 and April 15 to minimize impacts to sea turtles, fish, and shellfish, and infauna. It is anticipated construction will take 4 to 5 months, including mobilization.

The two borrow areas being used for beach compatible sand are designated in Figure 3. Areas to be affected by excavation of beach quality sand include up to 1,151 acres. Both have been surveyed by side-scan sonar, followed by the taking of numerous Vibracore samples in both potential borrow sites. This was done in order to avoid hard bottom areas during dredging, and adequate depths of sand were found in both areas. In addition to our own internal review where we looked for shallow depth of borings (hard bottom), deep sand deposits, and the presence of organic materials in the sample, South Carolina Department of Natural Resources (SCDNR) also reviewed the reports and findings and helped to outline those areas that should be avoided. Because of the dynamic nature of the coastal area and the constant movement of sand, it is expected that the borrow area will fill with sand of the same grain size after the pumping has been completed.

The primary borrow area for this project is a large area covering 1.3 square miles to the SE off the coast of Pawleys Island. It starts roughly at the 30-foot contour and is bounded to the east by the 3-mile line and to the west by the “M03” CBRA Zone. The secondary borrow area for this project is a 0.5 square mile area located between Pawleys Island and the primary borrow area. It starts about 1 mile from the shoreline and extends out to the 30-foot contour and is bounded to the south by the “M03” CBRA Zone. It has been surveyed in order to avoid hard bottom, but deposits of usable sand are typically only a few feet deep. Because of the shallow depth, depressions will not be created if the sand must be pumped to the beach. Due to the shallow nature of the deposits and because of the dynamic nature of the coastal area and the constant movement of sand, it is also expected that this potential borrow area will fill with sand of the same grain size. The same type of survey work was done on this site, and SCDNR also helped to eliminate those areas that might contain live bottom.

The majority of the sand (there is 2.5 million CY available) would be drawn from the primary borrow site, which is an 832 acre site (see Figure 3). Sand would be shaved off in layers until the required volumes were met, but the excavation would go no deeper than 5 feet. If additional material is needed, it will be removed from the 319-acre secondary site (there is 1.1 million CY available at this borrow site). Both areas have been carefully mapped out to avoid live/hard bottom, and no holes will be created. Upon completion of the work, approximately 65 acres of existing inter-tidal and sub-tidal zone will be covered with sand in the southern reach. Materials used for beach nourishment may also be transported onto other areas that support benthic communities; however, no hard bottoms or vegetated wetlands will be affected. Within sand borrow areas; benthic epifauna and infauna will be impacted by excavation and temporary turbidity that may extend beyond the excavation areas. Other potential impacts include localized turbidity elevation and possible reduction of dissolved oxygen in the surrounding water column. Elevated turbidity can reduce photosynthesis activity of pelagic and benthic algae. Suspended sediments can cause physical damage to respiratory structures of early life history stages of fishes and invertebrates.

The overall magnitude of these impacts are expected to be short term and minor under the dredging operations to be employed, and are as follows: Up to 832 acres of borrow area will have several feet of sand "shaved" off the top and transported to the beach. If the secondary site is utilized then another 319 acres could have several layers of sand "shaved" off. This sand would then be transferred to the beach, and up to 65 acres of inter-tidal and sub-tidal zone would be converted to the new beach profile. Although no hard bottoms or vegetated wetlands will be impacted, there will, no doubt, be impacts to the non-mobile benthic organisms in both the borrow areas and beach area. Re-colonization is expected to occur within 1 to 2 years. Turbidity will be short-lived and will clear as soon as the pumping of sand ceases.

Both borrow area acreages have been adjusted to match the amount of suitable sand depth. Larger areas had been evaluated but the above listed acreages are what remained after the Corps of Engineers and SCDNR review and evaluation process.

A testing plan for the physical analysis of sediments was been developed for the areas proposed as borrow sites. The testing will include grain size plus shell and organic content. Information gained from this testing will determine if the material proposed for dredging is suitable for beach placement.

The proposed work will be accomplished as soon as possible, subject to obtaining all the necessary environmental clearances. It is expected that the dredging can be initiated no sooner than November 2004, and the work will require about 3-5 months for completion. This schedule could change due to contractual issues, inclement weather, mechanical failure, or other unforeseen difficulties.

3.00 PRIOR CONSULTATIONS

No previous Section 7 formal or informal consultations are known to have occurred for this proposed Project.

4.00 LIST OF SPECIES

4.01 U.S. Fish and Wildlife Service

The US Fish and Wildlife (USFWS) provided a current list. The following species have been listed by the U. S. Department of Interior as occurring or possibly occurring in Georgetown County (from list dated October 01, 2002). For symbol key, see below:

E Federally endangered
T Federally threatened
P Proposed in the Federal Register
CH Critical Habitat
C The U.S. Fish and Wildlife Service or the National Marine Fisheries Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list these species
S/A Federally protected due to similarity of appearance to a listed species
SC Species of concern. These species are rare or limited in distribution but are not currently legally protected under the Endangered Species Act.
* Contact the National Marine Fisheries Service for more information on this species

Common Name	Scientific Name	Status	Occurrences
West Indian manatee	*Trichechus manatus*	E	Known
Finback whale	*Balaenoptera physalus**	E	Known
Humpback whale	*Megaptera novaeanqliae**	E	Known
Northern right whale	*Eubaleana glacialis**	E	Known
Sei whale	*Balaenoptera borealis**	E	Known
Sperm whale	*Physeter catodon**	E	Known
Bald eagle	*Haliaeetus leucocephalus*	T	Known
Red-cockaded woodpecker	*Picoides borealis*	E	Known
Wood stork	*Mycteria americana*	E	Known
Piping plover	*Charadrius melodus*	T/ CH	Known
Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
Leatherback sea turtle	*Dermochelys coriacea**	E	Known
Loggerhead sea turtle	*Caretta caretta*	T	Known
Green sea turtle	*Chelonia mydas**	T	Known
Shortnose sturgeon	*Acipenser brevirostrum**	E	Known
Sea-beach amaranth	*Amaranthus pumilus*	T	Known
Canby's dropwort	*Oxypolis canbyi*	E	Possible
Pondberry	*Lindera melissifolia*	E	Possible
Chaffseed	*Schwalbea americana*	E	Known
Dusky shark	*Carcharhinus obscurus**	C	Possible
Sand tiger shark	*Odontaspis taurus**	C	Possible
Night shark	*Carcharhinus signatus**	C	Possible
Speckled hind	*Epinephelus drummondhayi**	C	Possible
Jewfish	*E. itijara**	C	Possible
Warsaw grouper	*E. nigritus**	C	Possible

Common Name	Scientific Name	Status	Occurrences
Nassau grouper	*E. striatus**	C	Possible
Swallow-tailed kite	*Elanoides forficatus forficatus*	SC	Known
Awned meadowbeauty	*Rhexia aristosa*	SC	Known
Bachman's sparrow	*Aimophila aestivalis*	SC	Known
Carolina pygmy sunfish	*Elassoma boehlkei*	SC	Known
Carolina grass-of-parnassus	*Parnassia caroliniana*	SC	Known
Dune bluecurls	*Trichostema sp1*	SC	Known
One-flower baldunia	*Balduina uniflora*	SC	Known
Pindland plantain	*Plantago sparsiflora*	SC	Known
Pondspice	*Litsea aestivalis*	SC	Known
Reclined meadow-rue	*Thalictrum subrotundum*	SC	Known
Wire-leaved dropseed	*Sporobolus teretifolius*	SC	Known
Venus' fly-trap	*Dionaea muscipula*	SC	Known

Species proposed for listing: None
Designated Critical Habitat: None in the area of this project, however there is designated piping plover habitat adjacent to and north of the island (see Figure 2)
The U.S. Fish and Wildlife Service has designated critical habitat under the Endangered Species Act of 1973, as amended (Act), for the piping plover (*Charadrius melodus*) on breeding grounds in the Great lakes and Northern Great Plains Regions, and in the wintering grounds along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. This designation results in additional review requirements under section 7 of the Act.

4.02 The National Marine Fisheries Service

The National Marine Fisheries Service has posted a 6/21/2002 list on their Office of Protected Resources web site, indicating the following threatened (T) and endangered (E) species that are listed under that agencies jurisdiction of the South Atlantic area from North Carolina to Key West, Florida. The Endangered and Threatened Species and Critical Habitats list was also accessed on 01/10/2003 for details particular to South Carolina. Currently, there are no critical habitats listed for South Carolina:

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
Blue whale	*Balaenoptera musculus*	E	12/02/70
Finback whale	*Balaenoptera physalus*	E	12/02/70
Humpback whale	*Megaptera novaeangliae*	E	12/02/70
Right whale	*Eubaleana glacialis*	E	12/02/70
Sei whale	*Balaenoptera borealis*	E	12/02/70
Sperm whale	*Physeter macrocephalus*	E	12/02/70
Turtles			
Green sea turtle	*Chelonia mydas*	T*	07/28/78
Hawksbill sea turtle	*Eretmochelys imbricata*	E	06/02/70

Kemp's ridley sea turtle	*Lepidochelys kempii*	E	12/02/70
Leatherback sea turtle	*Dermochelys coriacea*	E	06/02/70
Loggerhead sea turtle	*Caretta caretta*	T	07/28/78
	Fish		
Shortnose sturgeon	*Acipenser brevirostrum*	E	03/11/67

Species proposed for listing: None
Designated Critical Habitat: None in the area of this project
Proposed Critical Habitat: None

Candidate Species**	Scientific Name
Fish	
Dusky shark	*Carcharhinus obscurus*
Sand tiger shark	*Odontaspis taurus*
Night shark	*Carcharinus signatus*
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*
Speckled hind	*Epinephelus drummondhayi*
Warsaw grouper	*Epinephelus nigritus*

*Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.
** Candidate species are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

5.00 GENERAL EFFECTS ON LISTED SPECIES/CRITCAL HABITAT

Since all aspects of the proposed work will occur either in the ocean or on the ocean beach, the project will not affect any listed species occurring in forested or freshwater habitats. Thus, the bald eagle, red-cockaded woodpecker, wood stork, Canby's dropwort, Pondberry, and chaffseed will not be affected by the proposed action. In addition, since there is no coastal river associated with this project, the shortnose and Atlantic sturgeons will not be affected by this project.

Species that could be present in the project area during the proposed action are the blue (NMFS list), finback, humpback, right, sei, and sperm whales. Also, the hawksbill (NMFS list), Kemp's ridley, leatherback, loggerhead, and green sea turtles could occur in the project area. However, loggerheads are the primary sea turtle nesters. The Florida manatee rarely visits the area but some sightings have been recorded over the years. Existing populations of seabeach amaranth have not been observed on the island since the year after hurricane Hugo ripped through the area in 1989, although there could be some sparse numbers to the north and south of the defined project. The piping plover is an occasional visitor and winters in the area. An area of critical habitat is located just to the north and across Midway Inlet, however, there are no current reported sightings of Piping plover on Pawleys Island and there is no designated Piping plover critical habitat within the impacted area.

6.00 SPECIES ASSESSMENTS

6.01 Blue (NMFS list), finback, humpback, right, sei, and sperm whales

The blue whale may be the largest mammal ever to inhabit the earth. It may have reached lengths of up to 100 feet - roughly the length of a basketball court. Blue whales have weighed up to 160 tons. They feed on small shrimp-like crustaceans. The whales consume up to eight tons of these animals a day during their feeding period. A blue whale produced the loudest sound ever recorded from an animal, and some scientists have speculated that they may be able to remain in touch with each other over hundreds of miles. The number of blue whales in the southern hemisphere was severely depleted by whaling. Due to commercial whaling the size of the population is less than ten percent of what it was originally.

The finback whale is the second largest whale, reaching lengths of up to 88 feet and weighs up to 76 tons. The finback whale because of its crescent-shaped dorsal fin, and obvious characteristic, is easily seen at sea. Depending on where they live, finback whales eat both fish and small pelagic crustaceans, and squids. It sometimes leaps clear of the water surface, yet it is also a deeper diver than some of the other baleen whales. The finback's range is in the Atlantic from the Arctic Circle to the Greater Antilles, including the Gulf of Mexico. In the Pacific Ocean the Finback ranges from the Bering Sea to Cape San Lucas, Baja California.

The humpback whale reaches a maximum length of about 51' long and a maximum weight of about 37.5 tons. They are mostly black, but the belly is sometimes white. Flippers and undersides of the flukes are nearly all white. They are migratory. They eat krill and schooling fish. In the Atlantic they migrate from Northern Iceland and Western Greenland south to the West Indies, including the Northern and Eastern Gulf of Mexico. In the Pacific Ocean they migrate from the Bering Sea to Southern Mexico. The humpback is one of the most popular whales for whale watching on both the east and west coasts. Scientists estimate that there are 10,000 humpbacks worldwide, only about 8% of its estimated initial population.

The sei whale is one of the largest whales. It can reach a length of 60 feet and a weight of 32 tons. They feed primarily on krill and other small crustaceans, but also feed at times on small fish. The sei whale is the fastest of the baleen whales and can reach speeds of more than 20 miles per hour. In the Atlantic Ocean the Sei whale ranges from the Arctic Circle to the Gulf of Mexico. In the Pacific Ocean the Sei whale may range from the Bering Sea to Southern Mexico. The Sei whale is endangered due to past commercial whaling.

Unlike the other great whales on the endangered species list, the sperm whale is a toothed whale. It is the largest of the toothed whales reaching a length of 60 feet in males and 40 feet in females. Sperm whales are noted for their dives that can last up to an hour and a half and go as deep as 2 miles under the surface. It is the most abundant of all the endangered whales, with an estimated population of two million. Sperm whales feed mainly on squid, including the giant squid. They range in the Atlantic Ocean from the Arctic Circle to the Gulf of Mexico. In the Pacific Ocean the sperm whale ranges from the Bering Sea to Southern Mexico. The sperm whale was almost hunted to extinction for its oil (spermaceti). This oil was used in the manufacture of ointments, cosmetics, and candles. The sperm whales usually inhabit the offshore waters.

The right whale is the most endangered species of whale off of the U.S. coasts. The right whale got its name because it was the "right" whale to hunt. It was slow moving and floated after being killed. Current estimates indicate that presently no more than a few hundred exist. Right whales can reach a length of 60 feet and a weight of 100 tons. Although the species has been internationally protected since 1937, it has failed to show any signs of recovery.

Right whales have been observed along the eastern coast of North America from the Florida Keys north to the Gulf of St. Lawrence in Canada. They are found in relatively large numbers around Massachusetts and near Georges Bank in the spring, and then they migrate to two areas in Canadian waters by mid-summer. Most cows that give birth in any given year travel in the winter to the coastal waters of Georgia and Florida to calve and raise their young for the first three months. The Bay of Fundy, between Maine and Nova Scotia, appears to serve as the primary summer and fall nursery hosting mothers and their first-year calves. The calf will stay with its mother through the first year and it is believed that weaning occurs sometime in the fall. Calves become sexually mature in about 8 years. Females are believed to calve about every three to four years. Sightings of right whales and their occurrence in the inshore waters of the State, although very rare, are generally assumed to represent individuals seen during this migration.

Right whales feed primarily on copepods and euphausids. They swim very close to the shoreline, often noted only a few hundred meters offshore. Because of their habit of traveling near the coast, there is concern over impacts resulting from collisions with boats and ships. Some right whales have been observed to bear propeller scars on their backs resulting from collisions with boats (NMFS, 1984). Destruction or pollution of right whale habitat is not known to be a problem in the project area. There is no designation of critical habitat for whales in SC.

Effect Determination

Of these six species of whales being considered, only the right whale would normally be expected to occur within the project area during the construction period; therefore the other species of whales are not likely to be affected. The majority of right whale sightings occur from December through February. Since the proposed work will occur during this time period, the dredge will be required to have endangered species observers standing watch on the bridge of the dredge to look for whales during construction. The presence of an essentially stationary hydraulic cutterhead pipeline or hopper dredge in this area should pose no direct impacts to the right whale, however, when relocating, the dredge and any supporting vessels are required to alter course and stop if necessary to avoid approaching whales. If whales are spotted during the day within 10 miles of the dredging operation, then the dredge is required to reduce transit speed at night, should it need to relocate during that time period. Corps contract specifications expressly require avoidance of right whales. This beach area has previously received borrow material to protect the island structures. This project will rebuild the protective berm with a greater level of stability than with previous non-Federal projects, but without impacting existing nearshore habitat conditions and food supplies already available to the right whale. For these reasons, it has been determined that the project as proposed is not likely to adversely affect the right whale. (The 29 October 1997 “National Marine Fisheries Service, Regional Biological Opinion on Hopper Dredging along the South Atlantic Coast” has jurisdiction on right whale effects)

6.02 Manatee

West Indian manatees are massive fusiform-shaped animals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like. Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Females have two axillary mammae, one at the base of each forelimb. Their bones are massive and heavy with no marrow cavities in the ribs or long bones of the forearms (Odell 1982). Adults average about 11.5 feet in length and 2,200 pounds in weight, but may reach lengths of up to 15 feet (Gunter 1941) and weigh as much as 3,570 pounds (Rathburn et al. 1990). Newborns average 4 to 4.5 feet in length and about 66 pounds (Odell 1981).

The West Indian manatee (*Trichechus manatus*) was listed as endangered on March 11, 1967, under a law that preceded the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.). Additional Federal protection is provided for this species under the Marine Mammal Protection Act of 1972, as amended (16 USC 1461 et seq.) The manatee population in the United States is confined during the winter months to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia (USFWS, 1996). However, during the summer months, they may migrate as far north as coastal Virginia on the East Coast and as far west as Louisiana on the Gulf of Mexico (USFWS, 1991). The manatee is an uncommon summer resident of the South Carolina coast with some visual reports in various locations along the coast, but no sightings in the Pawleys Island area have been reported to the SCDNR (personal communication with John Coker/SCDNR on 22 January 2003). There have been, however, recorded sightings (personal communication w/John Coker/SCDNR) of the manatee in the Murrells Inlet area: 2 sightings in 1993 (July & August), 1 sighting in July 1996, 5 sightings in July 1998, and 1 sighting in June 2000. These manatees would have had to pass through the Pawleys Island waters. There is no designation of critical habitat for the West Indian manatee in SC.

Effect Determination

The proposed work is currently scheduled to occur during the time of year when manatees are not visiting the area. In addition, since the proposed work is to be performed with either a hopper or pipeline dredge, a dredge plant that is essentially stationary, no direct impacts to the manatee are anticipated, should weather changes invite them to migrate northward early. For these reasons, it has been determined that the proposed project is not likely to adversely affect the manatee.

6.03 Kemp's ridley, leatherback, loggerhead, green, and hawksbill sea turtles

There are five species of sea turtles on the Atlantic Coast, Kemp's ridley sea turtle (*Lepidochelys kempii*), Leatherback sea turtle (*Dermochelys coriacea*), Loggerhead sea turtle (*Caretta caretta*), Green sea turtle (*Chelonia mydas)*, and the Hawksbill sea turtle (*Eretmochelys imbricata*). These five species of sea turtles are protected by the Convention on International Trade in Endangered Species (CITES). They are also listed as endangered or vulnerable in the Red Data Book by the International Union for the Conservation of Nature (IUCN). The hawksbill, Kemp's ridley and leatherback were listed as endangered by the U. S. Endangered Species Act in 1973. The green turtle and the loggerhead were added to the list as threatened in 1978.

Sea turtles vary in size from an average of 75 pounds for the olive ridley (does not occur in the project area) to the giant leatherback, which may exceed 800 pounds. Modified for living in the open ocean, they have paddle-like front limbs for swimming. The thick neck and head cannot be drawn back into the body. Sea turtles also have special respiratory mechanisms and organs to excrete excess salt taken in with seawater when they feed.

The leatherback is very different from the six other sea turtle species. Instead of plates (scutes) on the shell, the leatherback's carapace has seven hard longitudinal ridges along the length of the back. Its rubber-like covering is black with white spots and a pinkish-white underside. The average length of its shell is 5 feet. The green turtle is the second largest sea turtle and the loggerhead the third. Green turtles get their name from the color of their fat, not their shells, which are grayish in older animals. Loggerheads have rich reddish-brown shells and yellow on their undersides. The loggerhead's large skull provides for the attachment of strong jaw muscles for crushing conchs and crabs. The hawskbill has a patterned shell of brown and yellow with scutes that overlap like shingles on a roof. Its long, narrow head and beak enable it to feed among coral reefs. The smallest sea turtle is the Kemp's ridley; it has a drab olive to grayish-black shell.

Sea turtles occupy different habitats, depending upon their species, sex and age (size). Hatchlings and smaller juvenile loggerheads appear to live in floating mats of Sargassum in the open ocean. This seaweed offers cover, protection from predators and a source of food. Larger juveniles are generally seen in the same coastal habitat as the adults, especially during the summer.

Leatherbacks feed entirely on jellyfish, and they must often travel long distances to keep up with large concentrations of this food source drifting in the ocean currents. Green turtles are herbivorous and remain near pastures of turtle-preferred grasses. Often these pastures are not near their nesting beaches, so these turtles migrate hundreds of miles to nest. Loggerheads usually leave the cold, coastal waters in the winter and are often seen along the edge of the Gulf Stream. Hawksbills live on coral reefs almost year-round, feeding on sponges, sea squirts and other bottom organisms. Although the Kemp's ridley nests only on Mexico's Gulf Coast, small juveniles of this species and the green turtle occur along the South Carolina coast during the summer.

Very little is known about male sea turtles since they almost never come ashore. Male loggerheads are seen in near-shore waters during the spring and early summer breeding season but apparently move back offshore once breeding is completed. Since the reproductive cycles of all sea turtles are similar, a generalized version encompasses all. Mating takes place offshore, and the turtles must only mate once to fertilize all eggs laid during the nesting season. When nesting, the female crawls onto the beach, usually at night, and digs a hole in the sand with her hind flippers. After laying about 100 (number of eggs vary among species) white, leathery eggs, she covers them and returns to the sea. A single female may nest several times a season, usually at 2-week intervals. The eggs incubate about 60 days, depending on the weather. Hatchlings dig out of the sand at night and make their way to the sea using light cues for guidance. Destruction of nests and hatchling mortality at sea are usually high. It appears sea turtles' high number of eggs per clutch and several nestings per season offset this high mortality rate. Nesting habits of the Kemp's ridley deviate from those of other sea turtles. The Kemp's ridley is the only species that nests during the day. Most sea turtles do not nest every year. They return on either a 2- or 3-year cycle to the same general area or beach. Of these five species, only the loggerhead is considered to be a regular nester in SC. However, on September 9, 1996, a green sea

turtle laid 135 eggs on Garden City Beach and a leatherback nest was recorded on Huntington Beach State Park in 2000. Another green sea turtle also nested on Garden City Beach in 2002. There is no critical habitat designation for sea turtles in SC. For purposes of this assessment, the loggerhead is considered to be the only species likely to nest in the project area.

Loggerhead Sea Turtle. The loggerhead sea turtle has a worldwide distribution and is found in temperate and subtropical waters. Major nesting areas in North America occur along the Southeast Coast from North Carolina to Florida. Loggerhead sea turtles regularly nest along the southern coast of South Carolina from Georgetown south, usually from mid-May to August. Nesting is preferred on remote beaches-and away from human disturbance. The loggerhead is considered a turtle of shallow water with juveniles preferring bays and estuaries. An omnivore, crustaceans, molluscs, squid, jellyfish, fish, and plant materials are desirable foods. Stranding data reveals that up to 70% of all stranded sea turtles are loggerheads with the majority of strandings occurring from May to August. Therefore, it can be surmised that the potential presence of loggerheads in the project area would most-likely occur at this time. In Georgia, South Carolina and North Carolina the nesting season generally begins in mid-May and ends by mid-August. Nesting activity is greatest, however, in June and July. Loggerheads are known to nest from one to seven times within a nesting season; the mean is approximately 4.1. The internesting interval varies around a mean of about 14 days. There is general agreement that females mate prior to the nesting season (and possibly only once) and then lay multiple clutches of fertile eggs throughout some portion of the nesting season. Mean clutch size varies from about 100 to 126 along the southeastern United States coast. Loggerheads are nocturnal nesters, but exceptions to the rule do occur infrequently. Multi-annual remigration intervals of two and three years are most common in loggerheads, but the number can vary from one to six years. The length of the incubation period is related to nest temperature. Sex determination in loggerhead hatchlings is temperature dependent and the species apparently lacks sex chromosomes. Natural hatching success rates of 73.4 percent and 55.7 percent have been reported in South Carolina. Loggerhead hatchlings engage in a "swimming frenzy" for about 20 hours after they enter the sea and that frenzy takes them about 22 to 28 kilometers offshore. At some point thereafter they become associated with Sargassum rafts and/or debris at current gyres. Upon reaching about 45 cm mean straight carapace length (sCL), they abandon the pelagic existence and migrate to near-shore and estuarine waters of the eastern United States, the Gulf of Mexico and the Bahamas and begin the subadult stage. As adults, loggerheads become migratory for the purpose of breeding. Reported tag recoveries suggest a "migratory path" from Georgia to Cape Hatteras, North Carolina with a single recovery of a Georgia tagged female on the Florida Gulf Coast (Tampa Bay). Little else is known of the scheduled travels of Georgia, South Carolina, and North Carolina nesters outside of the nesting season (NMFS, USFWS, 1991).

Affected sea turtle environment. The areas of affected environment for this proposed project are the marine areas (an 832 acre site) proposed for borrow material dredging (see Figure 1) and the placement of 565,500 cubic yards of sand along 6,800 feet of beach between Groins #1 and #12 (the southern portion of the island) with 350-foot tapers on both ends (see Figures 3 and 4). This also includes placement within the intertidal and subtidal zones.

The approximate existing areas (in acres) of the areas proposed for sand placement are as follows:

- Dry Beach (i.e. above high tide) - approximately 15 acres
- Intertidal - approximately 25 acres
- Subtidal - approximately 40 acres

Upon completion of the project, the acreages of dry beach and intertidal zone will be as shown below. (Note: Due to erosion these acreages will change over time until being restored during periodic nourishments.) The total acreage of subtidal zone will not change; however, the location of this subtidal zone will be shifted seaward approximately 100 feet (see Figure 2).

- Dry Beach - approximately 40 acres
- Intertidal - approximately 15 acres

Removal of sand from the borrow areas may have an effect on Loggerhead sea turtles; however, these effects are covered by a National Marine Fisheries Service Biological Opinion, and, thus, are not discussed in this document.

The total existing area for sand placement encompasses approximately 80 acres; however, only the zone between the toe of the dune and MHW may be considered suitable sea turtle nesting habitat. Currently, the total area of this suitable sea turtle nesting habitat in the area of the project is approximately 15 acres. Upon completion of the project, the total area of suitable nesting habitat will be approximately 40 acres (see Figure 2: a typical cross-section, and Figure 4 for a hypothetical aerial view).

Current rangewide conditions for sea turtles. It is not possible, at present, to estimate the size of the loggerhead population in United States territorial waters if one includes subadults. There is, however, general agreement that enumeration of nesting females provides a useful index to population size and stability. It is estimated that 14,150 females nest per year in the southeastern United States. This estimate was based on aerial survey data from 1983 has been accepted as the best current approximation. Given a stochastically derived mean number of nests per female (4.1), this figure provides an estimate of approximately 58,000 nests deposited per year in the Southeast. Based on more extensive ground and aerial surveys throughout the Southeast in recent years (1987 to 1990), it is estimated that approximately 50,000-70,000 nests are deposited annually. These totals constitute about 35 to 40 percent of the loggerhead nesting known worldwide and clearly rank the southeastern United States aggregation as the second largest in the world, with the somewhat larger Oman assemblage being the only other truly large group remaining anywhere (NMFS, USFWS, 1991).

A recent review considered consequences of life tables and population models; mortality rates in the Southeast; population declines in South Carolina and Georgia; and estimates of annual mean clutch production per female. It was concluded that the stock of loggerheads represented by females that nest in the Southeast is continuing to decline (NMFS, USFWS, 1991).

Conditions for sea turtles in the project area. South Carolina United Turtle Enthusiasts (SCUTE) monitor approximately 78 km of beach in northern Georgetown and Horry Counties, and has participants on Pawleys Island provide them statistics for that area (email from Mary Schneider on 25 January, 2003). Local residents patrol the area. Pawleys Island consists of a combination of year-round residences, summer rentals, and a core group of historic structures in the center of the island. There is some good dune development in the center of the island where turtles can nest, but the south end of the island has few, if any, suitable sites. The northern end of the island has a broad depositional spit in front of it, with sufficient dune development to support nesting but almost no turtles use the area. If possible, nests are left where they are laid, but if deposited in front of a public access point or in an area that is

inundated on a regular basis, then they are relocated elsewhere on the island to improve hatching success. There were no nests recorded before 1991, but since then there have been anywhere from 1 to 20 nests per year (1991 to 2002). False crawls have been recorded from 1996 to 2002, but locations were not recorded.

The following information was obtained from Sally Murphy (SCDNR) and Mary Schneider (Pawleys Island resident and SCUTES participant). The following is a brief synopsis of sea turtle nesting at Pawleys Island. All data represents the efforts of loggerhead sea turtles (*Caretta caretta*). Please see the table below for the sea turtle data:

Total Number of Loggerheads Nesting on the Island from 1991 to 2002

		Known Nesting Origins		
	Entire Island	Area of Corps Project	Island Mid Section	Island Northern Reach
2002	06 Nests	02 Nests	00 Nests	00 Nests
2001	03 Nests	02 Nests	01 Nests	00 Nests
2000	13 Nests	06 Nests	07 Nests	00 Nests
1999	12 Nests	07 Nests	03 Nests	02 Nests
1998	10 Nests	05 Nests	00 Nests	00 Nests
1997	06 Nests	00 Nests	02 Nests	00 Nests
1996	07 Nests	00 Nests	02 Nests	01 Nests
1995	08 Nests	N/A	N/A	N/A
1994	20 Nests	N/A	N/A	N/A
1993	01 Nests	N/A	N/A	N/A
1992	10 Nests	N/A	N/A	N/A
1991	12 Nests	N/A	N/A	N/A .
Totals	108 Nests	22 Nests	15 Nests	03 Nests

The island fully supports the state goals for conserving sea turtles, which include the protection and documentation of all marine turtle nesting attempts and data collection on individual nests.

During the twelve-year period (1991-2002) a total of 108 nests were laid on the 3.6 miles of beach, averaging 9 nests per year. Total egg production data was not located, but overall hatching success for the sampling period 1997 to 2001 was known to be 78%.

Factors Impacting Nesting Success in the Area

In general, no other fact contributes to egg mortality more than nest predation prior to screening and locating the nest. A variety of natural and introduced predators such as raccoons, foxes, ghost crabs and ants prey on incubating eggs and hatchling sea turtles. Normally, it is expected that the raccoon (*Procyon lotor*) would be the principal predator, as it is throughout the coast, followed by fox and ghost crabs. Raccoons are known to patrol primary dune lines at night and dig up nests after they were buried in the dune. Raccoons may take up to 96 percent of all nests deposited on a beach. Since the SCUTES patrols generally begin at first light a predated turtle nest may lay open to the elements for over 8 hours. These nests may be empty or only have a few eggs remaining after predation. Any remaining eggs can be cleaned and then relocated, however, these small nests normally exhibit very low hatching success.

On Pawleys Island there have been no loses to foxes or raccoons for the last five years, but there have been a few loses to ghost crabs (email from Mary Schneider, 25 January 2003). In addition to the destruction of eggs, other predators may take considerable numbers of hatchlings just prior to or upon emergence from the sand (NMFS, USFWS, 1991).

Cumulative effects of actions in project area on sea turtles. Very little is known about sea turtle diseases or natural mortality rates. However, it is believed that declines in populations are a direct result of human actions. Erosion of nesting beaches can result in partial or total loss of suitable nesting habitat. Dynamic coastal processes, including sea level rise, influence erosion rates. Man's interference with these natural processes through coastal development and associated activities has resulted in accelerated erosion rates and interruption of natural shoreline migration. Where beachfront development occurs the site is often fortified to protect the property from erosion. Virtually all shoreline engineering is carried out to save structures, not dry sandy beaches, and ultimately, this results in environmental damage. One type of shoreline engineering, collectively referred to as beach armoring, includes sea walls, rock revetments, riprap, sandbag installations, groins and jetties. Beach armoring can result in permanent loss of a dry nesting beach through accelerated erosion and prevention of natural beach/dune accretion and can prevent or hamper nesting females from accessing suitable nesting sites. Clutches deposited seaward of these structures may be inundated at high tide or washed out entirely by increased wave action near the base of these structures. As these structures fail and break apart they spread debris on the beach that may further impede access to suitable nesting sites (resulting in higher incidences of false crawls) and trap hatchlings and nesting turtles. Sandbags are particularly susceptible to rapid failure and result in extensive debris on nesting beaches. Rock revetments, riprap and sand bags can cause nesting turtles to abandon nesting attempts or to construct improperly, sized and shaped egg cavities when inadequate amounts of sand cover these structures. Approximately 21 percent (234 km) of Florida's, 10 percent (18 km) of Georgia's and 10 percent (30 km;) of South Carolina's beaches are armored (NMFS, USFWS, 1991).

Groins and jetties are designed to trap sand during transport in longshore currents or to keep sand from flowing into channels in the case of the latter. These structures prevent normal sand transport and accrete beaches on one side of the structure while starving neighboring beaches on the other side thereby resulting in severe beach erosion and corresponding degradation of suitable nesting habitat. Beach nourishment consists of pumping, trucking or scraping sand onto the beach to rebuild what has been lost to erosion. Beach nourishment can impact turtles through direct burial of nests and by disturbance to nesting turtles if conducted during the nesting season. Sand sources may be dissimilar from native beach sediments and can affect nest site selection, digging behavior, incubation temperature (and hence sex ratios), gas exchange parameters within incubating nests, hydric environment of the nest, hatching success and hatchling emergence success. Beach nourishment can result in severe compaction or concretion of the beach. Trucking of sand onto project beaches may increase the level of compaction (NMFS, USFWS, 1991).

Significant reductions in nesting success have been documented on severely compacted nourished beaches. Compaction levels that have been evaluated at ten renourished east coast Florida beaches concluded that 50 percent were hard enough to inhibit nest digging, 30 percent were questionable as to whether their hardness affected nest digging and 20 percent were probably not hard enough to affect nest digging. In general, beaches nourished from offshore borrow sites are harder than natural beaches, and, while some may soften over time through erosion and accretion of sand, others

may remain hard for 10 years or more. However, it is not known if these conclusions on Florida beaches are applicable to South Carolina beaches. Nourished beaches often result in severe escarpments along the mid-beach and can hamper or prevent access to nesting sites. Nourishment projects result in heavy machinery, pipelines, increased human activity and artificial lighting on the project beach. These activities are normally conducted on a 24-hour basis and can adversely affect nesting and hatching activities. Pipelines and heavy machinery can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls (non-nesting emergences). Increased human activity on the project beach at night may cause further disturbance to nesting females. Artificial lights along the project beach and in the nearshore area of the borrow site may deter nesting females and disorient or misorient emergent hatchlings from adjacent non-project beaches (NMFS, USFWS, 1991).

Beach nourishment projects require continual maintenance (subsequent nourishment) as beaches erode and hence their negative impacts to turtles are repeated on a regular basis. Beach nourishment projects conducted during the nesting season can result in the loss of some nests which may be inadvertently missed or misidentified as false crawls during daily patrols conducted to identify and relocate nests deposited on the project beach. Nourishment of highly eroded beaches (especially those with a complete absence of dry beach) can be beneficial to nesting turtles if conducted properly. Careful consideration and advance planning and coordination must be carried out to ensure timing, methodology and sand sources are compatible with nesting and hatching requirements (NMFS, USFWS, 1991).

Extensive research has demonstrated that the principal component of the sea finding behavior of emergent hatchlings is a visual response to light. Artificial beachfront lighting from buildings, streetlights, dune crossovers, vehicles and other types of beachfront lights has been documented in the disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchling turtles. The results of disorientation or misorientation are often fatal. As hatchlings head toward lights or meander along the beach their exposure to predators and likelihood of desiccation is greatly increased. Misoriented hatchlings can become entrapped in vegetation or debris, and many hatchlings are found dead on nearby roadways and in parking lots after being struck by vehicles. Hatchlings that successfully find the water may be misoriented after entering the surf zone or while in nearshore waters. Intense artificial lighting can even draw hatchlings back out of the surf (NMFS, USFWS, 1991).

The problem of artificial beachfront lighting is not restricted to hatchlings. It has been indicated that adult loggerhead emergence patterns were correlated with variations in beachfront lighting in south Brevard County, Florida, and that nesting females avoided areas where beachfront lights were the most intense. It has also been noted that loggerheads aborted nesting attempts at a greater frequency in lighted areas. Problem lights may not be restricted to those placed directly on or in close proximity to nesting beaches. The background glow associated with intensive inland lighting, such as that emanating from nearby large metropolitan areas, may deter nesting females and disorient or misorient hatchlings navigating the nearshore waters. Cumulatively, along the heavily developed beaches of the southeastern United States, the negative effects of artificial lights are profound (NMFS, USFWS, 1991).

Residential and tourist use of developed (and developing) nesting beaches can result in negative impacts to nesting turtles, incubating egg clutches and hatchlings. The most serious threat caused by increased human presence on the beach is the disturbance to nesting females. Night-time human activity can cause nesting females to abort nesting attempts at all stages of the behavioral process. It has been

reported that disturbance can cause turtles to shift their nesting beaches, delay egg laying, and select poor nesting sites. Heavy utilization of nesting beaches by humans (pedestrian traffic) may result in lowered hatchling emergence success rates due to compaction of sand above nests and pedestrian tracks can interfere with the ability of hatchlings to reach the ocean. Campfires and the use of flashlights on nesting beaches misorient hatchlings and can deter nesting females (NMFS, USFWS, 1991).

Nest loss due to erosion or inundation and accretion of sand above incubating nests appear to be the principal abiotic factors that may negatively affect incubating egg clutches. While these factors are often widely perceived as contributing significantly to nest mortality or lowered hatching success, few quantitative studies have been conducted. Studies on a relatively undisturbed nesting beach indicated that excepting a late season severe storm event, erosion and inundation played a relatively minor role in destruction of incubating nests. Inundation of nests and accretion of sand above incubating nests as a result of the late season storm played a major role in destroying nests from which hatchlings had not yet emerged. Severe storm events (e.g., tropical storms and hurricanes) may result in significant nest loss, but these events are typically aperiodic rather than annual occurrences. In the southeastern United States, severe storm events are generally experienced after the peak of the hatching season and hence would not be expected to affect the majority of incubating nests. Erosion and inundation of nests are exacerbated through coastal development and shoreline engineering. These threats are discussed above under beach armoring (NMFS, USFWS, 1991).

The effects of dredging are evidenced through the degradation of habitat and incidental take of marine turtles. Channelization of inshore and nearshore habitat and the disposal of dredged material in the marine environment can destroy or disrupt resting or foraging grounds (including grass beds and coral reefs) and may affect nesting distribution through the alteration of physical features in the marine environment. Hopper dredges are responsible for incidental take and mortality of marine turtles during dredging operations. Other types of dredges (clamshell and pipeline) have not been implicated in incidental take (NMFS, USFWS, 1991).

Of all commercial and recreational fisheries conducted in the United States, shrimp trawling is the most damaging to the recovery of marine turtles. The estimated number of loggerheads killed annually by the offshore shrimping fleet in the southeastern United States Atlantic and Gulf of Mexico is 5,000 to 50,000. Incidental captures and drowning in shrimp trawls is believed to be the largest single source of mortality on juvenile through adult stage marine turtles in the southeastern United States. Most of these turtles are juveniles and subadults, the age and size classes most critical to the stability and recovery of marine turtle populations. Quantitative estimates of turtle take by shrimp trawlers in inshore waters have not been developed, but the level of trawling effort expended in inshore waters along with increasing documentation of the utilization of inshore habitat by loggerhead turtles suggest that capture and mortality may be significant. Trawlers targeting species other than shrimp tend to use larger nets than shrimp trawlers and probably also take sea turtles, although capture levels have not been developed. These fisheries include, but are not limited to bluefish, croaker, flounder, calico scallops, blue crab and whelk. Of these, the bluefish, croaker and flounder trawl fisheries likely pose the most serious threats. The harvest of Sargassum by trawlers can result in incidental capture of post hatchlings and habitat destruction (NMFS, USFWS, 1991).

Effect Determination

Loggerhead sea turtle nesting activities have been recorded within the project area on Pawleys Island. The placement of sand and construction activities associated with the placement of that sand on this reach of beach could adversely affect any existing sea turtle nests and sea turtles attempting to nest. The extent of nesting on Pawleys Island beach is considered to be minor and irregular when compared with many other beaches along the coast. Pawleys Island averages approximately 2.5 nests per mile. It is not anticipated that the construction work will extend into the nesting season; however, a standardized nest monitoring and relocation plan will be implemented if a situation should warrant its use.

(This type of plan normally incorporates monitoring of the beach sand placement areas each morning from the beginning of the nesting season until all equipment is removed from the beach and the relocation of any nests located within the project area. Using standard nest relocation techniques, all nests will be relocated to a suitable nursery beach area (most likely the northern or central reach), agreed to prior to the relocation effort by the USFWS and SCDNR. Hatching success of relocated nests will be monitored and reported. By following these methods, the possibility of a sea turtle nest being inadvertently buried by beach sand placement will be minimized. All nest monitoring and relocation on Pawleys Island will be accomplished by qualified personnel.)

In addition to the above-mentioned conservation measures, the Corps has developed a standard beach monitoring protocol to measure beach hardness/compaction after placement of sand on the beach. After the material is placed on the beach, any areas that are determined to have an in situ hardness greater than 500 Pounds per Square Inch (PSI) is tilled in order to make it suitable for sea turtle nesting. All of the dredging for the proposed project will be accomplished with either a hydraulic pipeline cutterhead dredge or a hopper dredge in the specified areas.

Visual surveys for escarpments along the Project area will be made immediately after completion of the storm protection Project and prior to May 1 for 3 subsequent years. Results of the surveys will be submitted to the USFWS prior to any action being taken. Since the Project should not occur during the sea turtle nesting season, escarpment leveling will not be performed until immediately prior to the nesting season. The USFWS will be contacted immediately if subsequent reformation of escarpments exceeding 18 inches in height for a distance of 100 feet occurs during nesting and hatching season. This coordination will determine what appropriate action must be taken. An annual summary of escarpment surveys and action taken will be submitted to the USFWS.

By monitoring beach hardness and assuring that it is suitable for sea turtle nesting, the project should maintain the suitability of the project area beaches for sea turtle nesting. The monitoring and relocation program will minimize potential adverse effects to nesting sea turtles. Completion of the project will recreate lost habitat and protect existing turtle nesting habitat as well as the structures on the island. However, because of the possibility of missing a sea turtle nest during the nest monitoring program or inadvertently breaking eggs during relocation, it has been determined that the project may adversely affect the loggerhead sea turtle.

6.03 Shortnose sturgeon

The Shortnose Sturgeon occurs in Atlantic seaboard rivers from southern New Brunswick to northeastern Florida. Department of Commerce studies have shown that the shortnose sturgeon exists in many of the large coastal river systems in South Carolina. Little is known about the shortnose sturgeon population level, life history or ecology. Their status is probably due to exploitation, damming of rivers and deterioration of water quality. Because there is no coastal river associated with this project, there is a lack of suitable freshwater spawning areas for the sturgeon in the immediate project area.

Effect Determination

It is unlikely that the shortnose sturgeon occurs in the project area, however, should it occur, its habitat would be only minimally altered by the proposed project. Any shortnose sturgeons in the area should be able to avoid being taken by a slow moving pipeline dredge or hopper dredge. For these reasons, it has been determined that the proposed project is not likely to adversely affect the shortnose sturgeon.

6.04 Piping plover and proposed piping plover critical habitat

Piping plovers are small shorebirds approximately six inches long with sand-colored plumage on their backs and crown and white under parts. Breeding birds have a single black breast band, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During the winter, the birds lose the black bands, the legs fade to pale yellow, and the bill becomes mostly black.

The piping plover breeds on the northern Great Plains, in the Great Lakes, and along the Atlantic coast (Newfoundland to North Carolina); and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico, and in the Bahamas West Indies.

Piping plovers nest along the sandy beaches of the Atlantic Coast from Newfoundland to North Carolina, the gravelly shorelines of the Great Lakes, and on river sandbars and alkali wetlands throughout the Great Plains region. They prefer to nest in sparsely vegetated areas that are slightly raised in elevation (like a beach berm). Piping plover breeding territories generally include a feeding area, such as a dune pond or slough, or near the lakeshore or ocean edge. The piping plover winters along the coast, preferring areas with expansive sand or mudflats (feeding) in close proximity to a sandy beach (roosting). The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (USFWS, 1996a).

The piping plover is an occasional visitor along the South Carolina coast during the winter months and individuals are occasionally sighted in the project area. However, there are no large wintering concentrations in the state. Piping plovers are considered threatened species under the Endangered Species Act of 1973, as amended, when on their wintering grounds. The species is not known to nest in the project area, although critical habitat is just to the north of the island. Pawleys Island is generally unsuitable for the species due to the heavy development along the ocean beach and heavy recreational use.

Just to the north of Pawleys Island, the USFWS has designated 0.6 miles of shoreline (SC-4) along the South Carolina (SC) coast as critical habitat for the wintering populations of the piping plover. This area is on the southern tip of Litchfield Beach (see Figure 5) to see the boundaries of this piping plover critical habitat in the project area), but due to it's location, this area could entice an occasional visit to Pawleys Island.

Effect Determination

Placement of the dredged material is currently scheduled to occur during the months of December through March. Direct loss of nests from the disposal of the dredged material should not occur, as the species is not known to nest in the project area. Piping plover foraging distribution on the beach during the winter months may be altered as beach food resources may be affected by placement of material along the southern reach. Such disruptions will be temporary and of minor significance. Any shorebird habitat area originally existing at the southern end of the island has suffered severe erosion. Dredged material will likely help to restore the habitat lost to erosion in this area while the protective berm is being constructed. The placement of dredged material into the intertidal zone on will provide additional foraging habitat for the wintering piping plover. For these reasons, it has been determined that the proposed project is not likely to adversely affect the piping plover. It has also been determined that the proposed project is not likely to adversely modify any critical habitat for wintering piping plovers.

6.05 Seabeach amaranth

Seabeach amaranth (*Amaranthus pumilus*) is an annual plant historically native to the barrier island beaches of the Atlantic coast from Massachusetts to South Carolina. No other vascular plant occurs closer to the ocean. The species was federally listed as threatened by the U.S. Fish and Wildlife Service in 1993 (USFWS, 1996b). Seabeach amaranth is listed as threatened and of national concern in South Carolina.

Germination takes place over a relatively long period of time, generally beginning in April and continuing at least through July. Upon germinating, this plant initially forms a small-unbranched sprig but soon begins to branch profusely into a clump, often reaching a foot in diameter and consisting of 5 to 20 branches. Occasionally a clump may get as large as a yard of more across, with hundreds or more branches. The stems are fleshy and pink-red or reddish, with small rounded leaves that are 1.3 to 2.5 centimeters in diameter. The leaves are clustered toward the tip of the stem, are normally a somewhat shiny, spinach-green color, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous and are borne in clusters along the stems. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June in the Carolinas but more typically commencing in July and continuing until their death in late fall or early winter. Seed production begins in July or August and reaches a peak in most years in September; it likewise continues until the plant dies (USFWS, 1996b).

Seabeach amaranth occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of noneroding beaches. It occasionally establishes small temporary populations in other habitats, including sound side

beaches, blowouts in foredunes, and in dredged material placed for beach renourishment or disposal. Seabeach amaranth appears to be intolerant of competition and does not occur on well-vegetated sites. The species appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. These characteristics allow it to move around in the landscape as a fugitive species, occupying suitable habitat as it becomes available (USFWS, 1996b).

Seabeach amaranth is a "fugitive" species that cannot compete with dense perennial beach vegetation and only occurs in the newly-disturbed habitat of a high-energy beach. It occurs on barren or sparsely-vegetated sand above the high water line, an area classified as marine wetland. This habitat usually disappears completely when seawalls or other hard structures are built along the shoreline. This loss of habitat from seawall construction and global sea level rise are thought to be major factors in the species' extirpation throughout parts of its historic range. It has been postulated that estuarine and coastal shore plants will suffer some of the most significant impacts as a result of global climate changes. Coastal development will prevent these species from migrating up slope to slightly higher ground if sea levels rise. To a large extent, this is already occurring as beaches are being fortified to prevent erosion. Beach renourishment projects eliminate existing plants if conducted during the summer and may bury the seed needed to reestablish the plant the following year if conducted during the winter. However, beach renourishment projects often rebuild the habitat this species requires. Fortification with seawalls and other stabilization structures or heavy vehicular traffic may eliminate seabeach amaranth populations locally. Any given site will become unsuitable at some time because of natural forces. However, if a seed source is no longer available in adjacent areas, seabeach amaranth will be unable to reestablish itself when the site is once again suitable or new favorable habitat is created. In this way, it can be progressively eliminated even from generally favorable stretches of habitat surrounded by permanently unfavorable areas (USFWS, 1996b).

Historically, seabeach amaranth occurred in 31 counties in 9 states from Massachusetts to South Carolina. It has been eliminated from six of the States in its historic range. The only remaining large populations are in North Carolina. Surveys in South Carolina found that the number of plants along our coast dropped by 90% (from 1,800 to 188) as a result of Hurricane Hugo, subsequent winter storms and beach rebuilding projects that occurred in its wake. South Carolina populations are still very low and exhibit a further downward trend although 1998 was a better year than most with 279 plants identified along the coast. It is possible that the abundant rainfall associated with El Nino in the spring of 1998 produced a larger than normal population. The remaining populations in areas with suitable habitat are in constant danger of extirpation from hurricanes, webworm predation, and other natural and anthropogenic factors (USFWS, 1996b).

There are Seabeach amaranth habitat areas on both the north and south ends of Pawleys Island, but the last survey was done in 1990. It is not known if the plants are still surviving on the island. The north end should not be impacted in any way by this project. There could, however, be a potential impact to the south end (if the plants are still present), when the sand taper is placed in front of the public access parking area. The Seabeach amaranth habitat area at the southern end of the island is located just beyond the parking area on the sand spit at the southernmost portion of the island (see Figure 6). Even though the overall southern third of Pawleys Island is eroding, this sand spit at the very southern tip has been growing southward since the previous spit was excavated several years ago. Due to its growth, this would be a potentially good area for plant growth, if it weren’t for the high level of public use.

The U.S. Fish and Wildlife Service has provided some documentation on the history of seabeach amaranth populations on Pawleys Island (reference USFWS Ed Eudaly's email of 13 January 2003). The last known survey was conducted in 1990 and the population statistics listed below came from status published by Weakley and Bucher.

Seabeach amaranth population counts for Pawleys Island
(No data available after 1990)

	1987	1988	1989	1990	1991 to 2002	2003 .
North End	135	96	Unknown	6	Unknown	Scheduled
South End	2	0	Unknown	1	Unknown	Scheduled

There is the possibility of a remnant population existing on the island but we won't know until a survey, scheduled for the summer of 2003 is completed.

Effect Determination

If there is a remnant population of amaranthus on the northern tip of Pawleys Island it will not be adversely impacted by the placement of sand on the southern end of the island. No habitat will be lost or gained and no existing (if any) plants impacted.

If there were a remnant population of amaranthus on the southern tip of Pawleys Island there would be the possibility that it could be adversely impacted by the proposed project. During the highest count year (1987), this would equate to a loss of habitat for 2 plants; during the lowest count years (1990), the loss would have been less - habitat for maybe 1 plant.

In general, the placement of borrow material on a beach will result in alterations of beach profile and can bury either plants or seeds depending on the period when the work is performed. On the surface, the impacts of such actions on the species would appear to be clearly adverse; however, an examination of seabeach amaranth distribution by the Wilmington District Corps office indicates that the species thrives in many frequently used beach disposal sites in NC. This possibly occurs because the disturbance generated by disposal actions mimics the natural disturbances found in its preferred habitat. This may illustrate that habitat maintenance, rather than maintenance of individual plants, is of overriding importance to the species.

Since the proposed work is scheduled to take place in the winter time frame, seabeach amaranth will probably not be germinating until after the sand is placed. Therefore, if any seed stock still exists in this area, flowering plants may not be able to germinate due to burial. Numerous conversations and one site inspection of the area was conducted with the USFWS to assess where the plants might be found when growing and initiate a determination of what conservation measures can be implemented to minimize adverse impacts to seabeach amaranth plants, seed banks and habitat. The island survey to be conducted during the summer of 2003 by the USFWS will map (by GPS) all the existing seabeach amaranth habitat and plants. If it is found that there is a significant population and seed bank in the public use area located on the sand spit on the southern end of the island, a decision will be made by the Corps and USFWL as to whether the area should be scraped (by bulldozer) to a depth of 6"-12" and

temporarily stockpiled until the placement of sand is completed. After the remaining areas on the sand spit settle from the effects of the sand placement, the seed bank material previously scraped and stockpiled from the area could be redistributed on areas selected by a USFWL team during the amaranth survey and mapping effort. It is possible that the above described conservation effort will be unable to be carried out due to a lack of suitable habitat areas on the remaining area of the sand spit due to the effects of the sand placement; however, the placement of the borrow material on beaches may also help to maintain desirable habitat for the species. Any existing seeds or those transported to the area may germinate and thrive in the newly deposited material. If this is the case, the proposed project will be beneficial to the long-term survival potential of the species at the southern end of Pawleys Island.

The sand spit will most likely continue its accretion/migration toward the south for the foreseeable future. As the sand spit accretes, habitat for amaranthus should be created. This accreted area may be repopulated by seabeach amaranth seeds that either remain in the sand spit while the sand placement is completed, wash in from material growing elsewhere, or from the seed bank material scraped up and stockpiled (if done so) prior to placement. The extent of the seed bank (if any) that remains is unknown, and what is there (if anything) may not be sufficient to repopulate the area after the protective sand material is placed. If a resident population of Seabeach amaranth is located during the summer of 2003, the Corps will perform seabeach amaranth surveys on the area for 2005, 2006, and 2007. Data regarding impacts will be available after these monitoring efforts are completed. Because habitat for seabeach amaranth may be removed in this one area, we have determined that constructing this project as proposed may adversely affect seabeach amaranth.

7.0 SUMMARY OF PROTECTIVE MEASURES

Manatee

Should a change in the schedule necessitate work during the manatee migration period, personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees. The Contractor may be held responsible for any manatee harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the Endangered Species Act and could result in prosecution of the Contractor under the Endangered Species Act or the Marine Mammals Protection Act. The standard manatee conditions apply annually from 1 June to 30 September. The Contractor will be instructed to take necessary precautions to avoid any contact with manatees. If manatees are sighted within 100 yards of the dredging area, all appropriate precautions will be implemented to insure protection of the manatee. The Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than 100 yards of the manatee. Operation of equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment.

Right Whales

Since the construction is anticipated to be scheduled during the Right whale migration period, personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing Right whales. The Contractor may be held responsible for any whale harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the Endangered Species Act and could result in prosecution of the

Contractor under the Endangered Species Act or the Marine Mammals Protection Act. The time when most Right whale sightings occur is December, January, and February. The Contractor will be instructed to take necessary precautions to avoid any contact with whales. If whales are sighted within 1000 feet of the borrow area, all appropriate precautions shall be implemented to insure protection of the whale. In addition, the Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than this distance.

Sea Turtles
(If some construction work ends up being done during the nesting season)

Should a change in the schedule necessitate work during the sea turtle nesting time period, in order to minimize impacts to nesting sea turtles a beach monitoring and nest relocation program for sea turtles will be implemented. This program will include daily patrols of sand placement areas at sunrise, relocation of any nests laid in areas to be impacted by sand placement, and monitoring of hatching success of the relocated nests. Sea turtle nests will be relocated to an area suitable to both the USFWS and the SCDNR. The Corps will perform any necessary maintenance of beach profile (tilling and shaping or knocking down escarpments) during construction and prior to each nesting season.

During construction of this project, staging areas for construction equipment will be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all dredge pipes that are placed on the beach will be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes will be off the beach to the maximum extent possible. Temporary storage of pipes on the beach will be in such a manner so as to impact the least amount of nesting habitat and will likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline will be recommended as the method of storage).

During construction of this project, all on-beach lighting associated with the project will be limited to the immediate area of active construction only. Such lighting will be shielded, low-pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters will be placed over vehicle headlights (i.e., bulldozers, front end loaders). Lighting on offshore equipment will be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded, low pressure sodium vapor lights will be highly recommended for lights on any offshore equipment that cannot be eliminated.

Seabeach amaranth

Protective measures to be implemented for seabeach amaranth plants, seed bank, and habitat located on Pawleys Island (if any) will be determined prior to beginning project as described above.

8.0 SUMMARY EFFECT DETERMINATION

This assessment has examined the potential impacts of the proposed project on the habitat and listed species of plants and animals that are, or have been, present in the project area. Both primary and

secondary impacts to habitat have been considered. Critical habitat has not been designated for whales, manatees, sea turtles, sturgeon, or seabeach amaranth in South Carolina; therefore, none would be affected. The USFWS designated critical habitat for the wintering piping plover is adjacent and to the north of the island, but not on the island. Based on this analysis, the following determinations have been made.

- It has been determined that the proposed project is not likely to adversely affect the blue (NMFS list), finback, humpback, right, sei, or sperm whales.
- It has been determined that the proposed project is not likely to adversely affect the manatee.
- It has been determined that the proposed project is not likely to adversely affect Kemp's ridley, leatherback, green, or hawksbill sea turtles.
- It has been determined that the proposed project is not likely to adversely affect the shortnose sturgeon.
- It has been determined that the proposed project is not likely to adversely affect the piping plover.
- It has been determined that the proposed project is not likely to adversely modify proposed critical habitat for the wintering piping plover.
- It has been determined that the proposed project may adversely affect the nesting loggerhead sea turtle.
- It has been determined that the proposed project may adversely affect the seabeach amaranth.

8.0 List of Contacts Made

Extensive use was made of the research, communication, and coordination meetings that were part of the Biological Assessment prepared for the Operations and Maintenance Dredging and Disposal work for the April 2001, Murrells Inlet Project in Georgetown County, South Carolina.

In additional to all the coordination that occurred with the development of that document, most of which equally applies to this project area, there is continuous contact with USFWS, SCDNR, SCDHEC, NMFS, and SCUTES with regard to this coastal projects and the development of the supporting EA and water quality work (all of which is utilized in this document).

Extensive verbal communication and coordination meetings have occurred and will continue to occur with USFWS, SCDNR, SCDHEC (OCRM), and National Marine and Fisheries Service (NMFS) to adequately address environmental concerns until the storm damage protection project is completed. The following list will identify some of the individuals contacted by the Corps for environmental coordination.

USFWS – Ms. Paula Sisson and Mr. Ed EuDaly
SCDNR - Ms. Sally Murphy and Mr. John Coker
NMFS - Mr. Prescott Brownell and Mr. Eric Hawk
Pawleys Island SCUTES team - Dr. Philip Schneider and Mrs. Mary Schneider

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Appendix A

APPENDIX B